

Facies and Stratigraphic Architecture of Saskatchewan's Oil Sands

Dan Kohlruss¹, Guoxiang Chi² and Per Kent Pedersen³

The oil sands of the Mannville Group's Dina Member are located in the extreme northwestern portion of Saskatchewan's sedimentary basin directly adjacent to the Alberta border, north of the Clearwater River and south of the Precambrian Shield. The Dina sub-crops below Pleistocene glacial deposits and resides primarily within sub-Mesozoic, paleo-topographic erosional lows. The bitumen saturated sandstones represent a significant resource with estimates as high as 2.3 billion barrels (371 million m³) in place.

The Dina Member is stratigraphically equivalent to the lower portions of the McMurray Formation of Alberta and represents a proximal eastern extension of Alberta's Athabasca basin oil sands deposits. Throughout the study area, the Mannville Group was extensively eroded by Pleistocene glacial processes and subsequently overlain by a thick succession of glacial till. The preserved Dina member sediments were deposited on underlying Devonian carbonates within paleo-topographic lows. These lows were developed as part of an incised valley system and Dina Sediments were deposited during a subsequent relative sea level rise.

Analysis of core drilled by Oilsands Quest Inc. in the study area indicates that the Dina member is represented by a wide range of clastic facies, including pebble conglomerates, coarse to fine sandstones, siltstones, mudstones and coals, however, the dominant lithology is fining upwards coarse to medium grained bitumen saturated sandstones. Eight recurring sedimentary facies have been identified in the study area's Dina Member deposits and are distinguished based on a combination of lithology, physical sedimentary and biogenic structures. These facies are interpreted to represent depositional systems ranging from high and low energy non-marine fluvial to marginal marine fluvio-tidal environments.

¹Saskatchewan Geological Survey, Saskatchewan Ministry of Energy and Resource, 201 Dewdney Ave. East, Regina, Canada S4N 4G3

²Department of Geology, University of Regina, Regina, SK

³Department of Geoscience, University of Calgary, 2500 University Dr. NW, Calgary, Alberta, Canada, T2N 1N4

Dan Kohlruss graduated in 1997 from the University of Regina with a B.Sc. in Geology. From 1997 to 2001 Dan consulted as a wellsite geologist throughout Alberta and Saskatchewan. In 2001 he started with Saskatchewan's Department of Energy and Mines and has been with the Saskatchewan Geological Survey since 2007 as a Petroleum Research Geologist. Concurrently, Dan is working on completing his M.Sc. at the University of Regina. Dan's current research includes clastic sedimentology and stratigraphy with a focus on Saskatchewan's oil sands, Mannville Group and Bakken Formation.